Southern California Priority Corridor
Showcase Program Evaluation

Corridor-Wide Advanced Traveler Information System Project (CWATIS) Evaluation Report

FINAL

July 16, 2003

Document No. 65A0030/0033
Task No. 5-12

Prepared for
California Department of Transportation
Division of Research & Innovation, MS-83
1227 O Street
Post Office Box 942873
Sacramento, California 94273-0001

Prepared By
BOOZ ALLEN HAMILTON INC
1615 Murray Canyon Road, Suite 220
San Diego, California 92108

CONTENTS

Disclaimer

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California, Caltrans or the U.S. Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Abbreviations & Acronyms

ATIS	Advanced Traveler Information System
ATMS	Advanced Transportation Management System
AVL	Automatic Vehicle Location
Caltrans	California Department of Transportation
CCTV	Closed-circuit Television surveillance camera
CHP	California Highway Patrol
CM	Configuration Management
CMP	Configuration Management Plan
CMS	Changeable Message Sign
CONOPS	Concept of Operations
CORBA	Common Object Request Broker Architecture
COTS	Commercial Off-the-Shelf
CTC	California Transportation Commission
CVO	Commercial Vehicle Operations
CW	Corridor-wide
CWATIS	Corridor-wide Advanced Traveler Information System Project
CWATMS	Corridor-wide Advanced Transportation Management System Project
CWCVO	Corridor-wide Commercial Vehicle Operations Project
CWSIP	Corridor-wide Systems Integration Project
CWSPP	Corridor-wide Strategic Planning Project
DOIT	California Department of Information Technology
DRI	Caltrans Division of Research & Innovation (formerly NTR)
EAP	Evaluation Activity Plan
EP	Evaluation Plan
FHWA	Federal Highway Administration
FSR	Feasibility Study Report
FTA	Federal Transit Administration
FTE	Full-Time Equivalent (one full-time employee)
GPRA	Government Performance and Results Act
GUI	Graphical User Interface
HP	Hewlett-Packard
HQIT	Headquarters - Information Technology (division of Caltrans)
IDL	Interface Definition Language
IPR	Intellectual Property Rights
ISSC	Information Systems Service Center (division of Caltrans)
ISTEA	Intermodal Surface Transportation Efficiency Act (of 1991)
ITS	Intelligent Transportation Systems
IWS	Integrated Workstation
LACDPW	Los Angeles County Department of Public Works
LADOT	City of Los Angeles Department of Transportation
LAN	Local Area Network
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization

MTA	Los Angeles County Metropolitan Transportation Authority
MTBF	Mean Time Between Failure
NDA	Non-Disclosure Agreement
NET	National Engineering Technology Corporation
NTCIP	National Transportation Communications for ITS Protocol
NTR	Caltrans Division of New Technology & Research (now DRI)
OCTA	Orange County Transportation Authority
O&M	Operations and Maintenance
OMM	Operations & Maintenance Model
OS	Operating system (such as Windows™, Unix, Linux, et. al.)
PC	Personal Computer (Windows™-based)
RCTC	Riverside County Transportation Commission
RFP	Request for Proposals
RTP	Regional Transportation Plan
RTPA	Regional Transportation Planning Agency
RWS	Remote Workstation
SANBAG	San Bernardino Association of Governments
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCPCSC	Southern California Priority Corridor Steering Committee
SOW	Statement of Work
TEA-21	Transportation Equity Act for the 21st Century
TMC	Transportation Management Center
USDOT	United States Department of Transportation
VDS	Vehicle Detector Station
VOS	Volume/Occupancy/Speed
VCTC	Ventura County Transportation Commission
WAN	Wide Area Network

Executive Summary

Background

As required by federal law, all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation to help planners and decision-makers at the federal, state and local levels make better-informed decisions regarding future ITS deployments. This report presents the experiences, costs, and lessons learned from Southern California's Corridor-wide Advanced Traveler Information System (CWATIS) project.

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which ITS could have particular benefit. Southern California suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels. The Southern California Priority Corridor is one of the most populated, traveled, and visited regions in the country, and consists of four adjoining regions:

- Los Angeles County and portions of Ventura County
- Orange County
- San Diego County
- Inland Empire (San Bernardino and Riverside Counties)

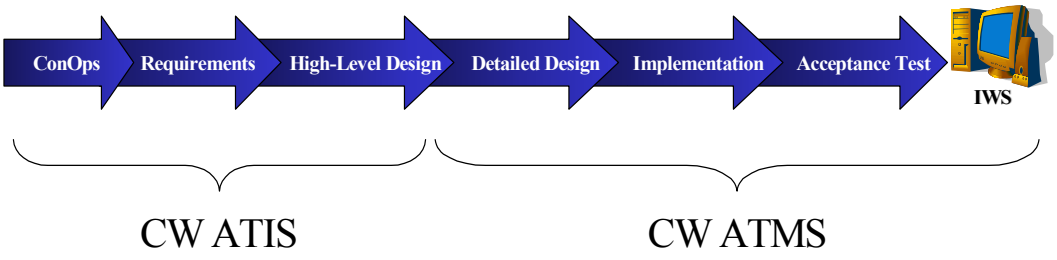
The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts. The Showcase Program consists of 17 ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Each Showcase project deploys a piece of this corridor-wide ITS network, including regional Advanced Traveler Information Systems (ATIS), regional Advanced Transportation Management Systems (ATMS), and regional and interregional communications infrastructure. Eleven of the projects are regional in nature, while the remaining six are corridor-wide. CWATIS is one of the six corridor-wide projects within the Southern California Priority Corridor ITS Showcase Program.

The CWATIS project helped design – but not build – an Integrated Workstation (IWS) that would bring together into one system all of the functionality from the various regional systems such as TravelTIP and IMAJINE. The IWS represents the next evolutionary step in the development of Showcase's interregional, corridor-wide capability.

Specifically, the CWATIS project completed the first steps of the systems engineering process by developing the Concept of Operations (ConOps), Requirements, and High-

Level Design for the IWS. The CWATMS project, not yet underway, was intended to build on the CWATIS effort and complete the systems engineering process by developing the Detailed Design and implementing the IWS. The breakdown of the planned IWS development is depicted in Exhibit 1.

Exhibit 1 – Relationship Between the CWATIS and CWATMS Projects



Evaluation Findings, Conclusions, and Recommendations

The CWATIS project successfully conducted corridor-wide Gap Analyses for both ATIS and ATMS, and developed an Operations Model, Requirements, and High-Level Design for the IWS. One of the most noteworthy features regarding this project is how it deviates from the Design-Build approach taken by most of the other Showcase projects. By splitting the Design and Build phases into separate contracts, Caltrans was better able to estimate and control the use of resources.

Showcase's fixed-price Design-Build contracts have been a source of consternation for both the public agencies and the private contractors developing the systems. Showcase's system developers are asked to commit to a firm fixed price without knowing what, specifically, they are being asked to develop. Project scopes in the RFPs generally have been oriented towards ensuring that a systems engineering process be followed, but not clearly defining the intended end product. In fact, helping to define the end product through a Needs Assessment is often one of the first tasks in the Scope of Work. The result of a fixed-price Design-Build contract is that the agency gets only as much as the project budget will buy, but not necessarily a solution that meets all of the agency's immediate needs, requirements, or initial expectations.

Other Showcase projects have shown that the most unpredictable part of an ITS project is the design phase. The consensus building activities required to develop a satisfactory Concept of Operations (ConOps), Requirements, and High-Level Design can require this phase alone to take more than 18 months to complete. Much depends on the institutional framework, relationships, and agreements that already exist. Experience has shown that – in many cases – it is futile to proceed with a system implementation until the institutional agreements (multi-jurisdictional operations policies, cooperative agreements, MOUs, etc.) are in place to promote and support operation of the system. Delays and

cost overruns resulting from failing to accurately estimate the job's requirements can put both the system developer and the agency contract manager at risk. For the system developer, this risk is financial. For the agency contract manager, the risk is that the delay or cost overrun will trigger an audit, or that the system will not be built to the stakeholder's needs/requirements.

By splitting the Design and Build phases, Caltrans was able to begin design of the system and develop a clear vision of the end product before committing any additional resources to build it. Based on this refined understanding of what they wanted to achieve, the project team was able to identify that another Showcase project (San Diego's IMTMC) was already developing a functionally similar system (the Intermodal ATMS, or ATMSi). Based on this, Caltrans chose not to proceed with the CWATMS project and the implementation of the IWS. By not "reinventing the wheel," the project team will save taxpayer dollars by utilizing ATMSi instead of continuing with the redundant development of the IWS.

1 Introduction

1.1 Purpose and Scope of this Report

As required by federal law[1], all Intelligent Transportation System (ITS) projects that receive federal funding must undergo an evaluation to help assess the costs and benefits of ITS. The information provided in this report is intended to help planners and decision-makers at the federal, state and local levels make better-informed decisions regarding future ITS deployments based on the experiences of Southern California's CWATIS project.

This document is one of 23 reports produced as part of the Southern California ITS Priority Corridor Showcase Program Evaluation, and covers only the events and findings resulting from the CWATIS evaluation. The complete set of findings from the Showcase Program Evaluation are found in the following collection of documents:

Document Type/Title	Date	Document Number
17 Individual Project Evaluation Reports		
Corridor-wide ATIS Project Report	**7/16/2003**	**65A0030/0033**
Corridor-wide ATMS Project Report	TBD	
Corridor-wide CVO Project Report	TBD	
Corridor-wide Rideshare Project Report	TBD	
Corridor-wide Strategic Planning Project Report	10/29/2002	65A0030/0028
Fontana-Ontario ATMIS Project Report	TBD	
IMAJINE Project Report	3/17/2003	65A0030/0029
IMTMC Project Report	TBD	
InterCAD Project Report	4/2/2003	65A0030/0030
Kernel Project Report	5/30/2003	65A0030/0031
LA ATIS Project Report	TBD	
Mission Valley ATMIS Project Report	TBD	
Mode Shift Project Report	TBD	
OCMDI Project Report	TBD	
Traffic Signal Integration Project Report	TBD	
Transit Mgt System Project Report	TBD	
TravelTIP Project Report (Draft)	6/3/2003	65A0030/0036
5 Cross-Cutting Evaluation Reports		
System Performance Cross-Cutting Report	TBD	
Costs Cross-Cutting Report	TBD	
Institutional Issues Cross-Cutting Report	TBD	
Information Management Cross-Cutting Report	TBD	
Transportation System Impacts Cross-Cutting Report	TBD	
Final Summary Evaluation Report		
Showcase Program Evaluation Summary Report	TBD	

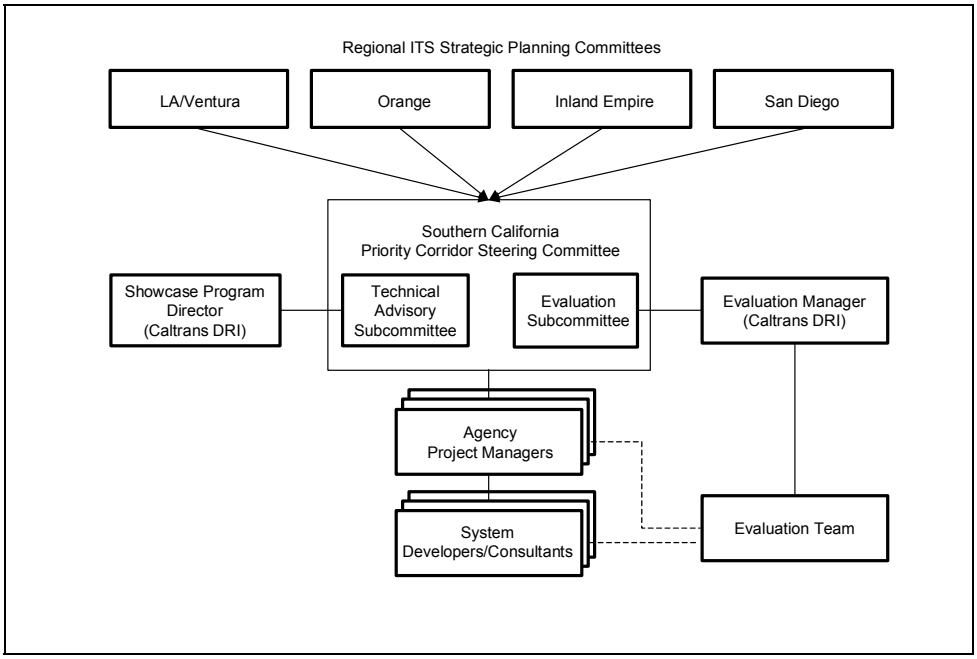
"TBD" indicates a future deliverable that is not yet available.

1.2 Evaluation Design and Approach

The findings outlined in this report are based on over five years of personal observations at project meetings, reviews of released project documents and agency memos, as well as formal and informal interviews and discussions with project partners.

The evaluation is responsive to the needs and suggestions of the Priority Corridor's Evaluation Subcommittee, which reports to the Priority Corridor's Steering Committee. As shown in Exhibit 2, both committees are comprised of stakeholders from the federal, state, and local levels.

Exhibit 2 – Management Structure and Organization of the Showcase Program



The Steering Committee's member agencies reflect wide representation from the region in terms of federal and state highway agencies, public safety, cities and counties, transit, air quality and regional planning entities, including:

- California Highway Patrol (CHP)
- Caltrans, Division of Traffic Operations (headquarters)*
- Caltrans, District 7*
- Caltrans, District 8*
- Caltrans, District 11*
- Caltrans, District 12
- City of Irvine*
- City of Los Angeles Department of Transportation (LADOT)
- City of San Diego
- Federal Highway Administration (FHWA)*

- Federal Transit Administration (FTA)
- Los Angeles County Metropolitan Transportation Authority (LACMTA)
- Orange County Transportation Authority (OCTA)
- Riverside County Transportation Commission (RCTC)
- San Bernardino Association of Governments (SANBAG)
- San Diego Association of Governments (SANDAG)
- South Coast Air Quality Management District (SCAQMD)
- Southern California Association of Governments (SCAG)

* Indicates an Evaluation Subcommittee member

The Showcase Program's Evaluation Design is based on a set of evaluation Goals and supporting Objectives and Measures that were developed by the Evaluation Team in partnership with federal, state and local stakeholders, and documented in the "Showcase Program Evaluation Approach" in 1998. Each individual Showcase project is evaluated based on an applicable subset of these Goals, Objectives, and Measures in order to help ensure that summary evaluation results can be aggregated from across the multiple Showcase project evaluations. The Showcase Program's five evaluation Goals include:

- Evaluate System Performance
- Evaluate Costs
- Evaluate Institutional Issues and Impacts
- Evaluate the Use and Management of Transportation/Traveler Information
- Evaluate Transportation System Impacts

As CWATIS evolved, project-specific refinements to the evaluation design were documented in a high-level Evaluation Plan (EP) and a detailed Evaluation Activity Plan (EAP). In general, the EP describes the project and/or system under evaluation, and lays the foundation for further evaluation activities by developing consensus among the Evaluation Subcommittee and project partners as to which of Showcase's evaluation Goals, Objectives, and Measures best apply to the project.

As the project matured, and after the EP had been approved, an EAP was developed to plan, schedule, and describe specific activities (interviews, surveys, etc.) and step-by-step procedures for conducting the evaluation. Data collection began after both plans had been reviewed and subsequently approved by the Evaluation Subcommittee and the project's partners.

1.3 Organization of this Report

The CWATIS Evaluation Report provides a background description of the Southern California Priority Corridor and its transportation challenges. This is followed by descriptions of the Showcase Program and the CWATIS project, including a detailed technical description. In general, each evaluation report is subdivided and ordered into the five topic areas described below:

System Performance — where appropriate, this section provides important benchmark information regarding system availability, reliability, scalability and compatibility. The evaluation quantifies those items and could be used to identify needed improvements and help develop specifications for future systems.

Cost — provides important benchmark information regarding project budget, funding sources, software licensing, development costs, costs to re-deploy elsewhere or expand the system, and any operations and maintenance (O&M) costs.

Institutional Impacts — provides important information regarding the administrative, procedural and legal impacts resulting from the project. Such impacts might include changes in operator workloads and responsibilities, as well as limitations or changes to agency-wide policies, procedures and guidelines.

Transportation & Traveler Information Management — where appropriate, provides important benchmark information on system usage and user acceptance (by both agency operators and the general public). This section provides both quantitative and qualitative findings on those items and can be used to identify user demand, needed improvements and potential areas of future growth.

Transportation System Impacts — where appropriate, this section provides important information regarding a project's impacts to transit usage, traffic congestion, air quality, and traffic safety.

The report concludes with a summary, final remarks and recommendations for next steps. Several appendices contain supporting documentation such as technical designs and copies of evaluation data collection instruments (blank questionnaires and survey).

1.4 Privacy Considerations

Some of the information acquired in the interview and discussion process could be considered sensitive and has been characterized in this report without attribution. The Evaluation Team has taken precautions to safeguard responses and maintain their confidentiality. Wherever possible, interview responses have been aggregated during analysis such that individual responses have become part of a larger aggregate response. The names of individuals and directly attributable

quotes have not been used in this document unless the person has reviewed and expressly consented to its use.

1.5 Constraints & Assumptions

The CWATIS evaluation is subject to the following constraints and assumptions:

- The project's consultant was not required to disclose actual project expenses, so the project's cost is based on the fixed-price budget stipulated in the CWATIS contract and its amendments. The budget reflects the expenses and costs for services paid by the client agency, but not necessarily the actual detailed costs for goods and services borne by the contractor.

1.6 Project Background

1.6.1 The Southern California Priority Corridor

In 1993, the U.S. Department of Transportation designated Southern California as one of four Priority Corridors in which Intelligent Transportation Systems (ITS) could have particular benefit. The Southern California Priority Corridor, illustrated in Exhibit 3, is one of the most populated, traveled, and visited regions in the country. Roughly two-thirds of the state's population – about 20 million people – resides in or around the Southern California Priority Corridor. It suffers from extreme traffic congestion, limited room for expanding transportation facilities, and above-average air pollution levels.

The Southern California Priority Corridor consists of four distinct regions that correspond with the four Southern California Caltrans districts:

- Los Angeles/Ventura (Caltrans District 7)
- Orange County (Caltrans District 12)
- San Diego (Caltrans District 11)
- Inland Empire (Caltrans District 8)

Exhibit 3 – The Southern California Priority Corridor and Vicinity

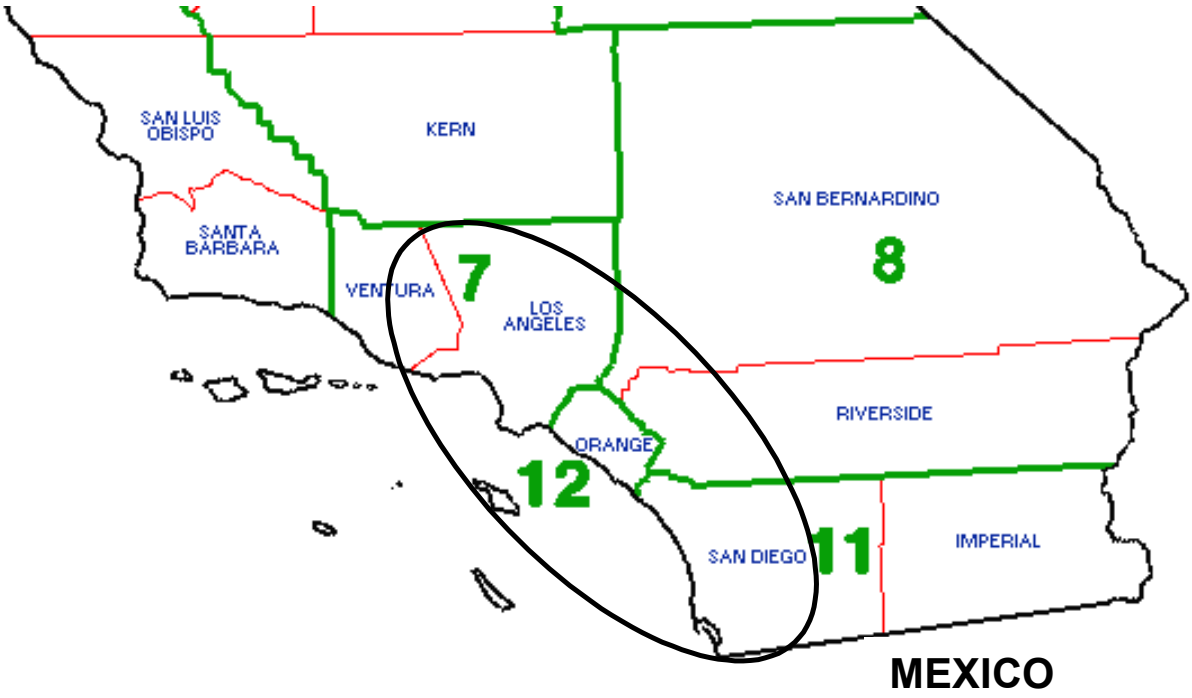


Exhibit 4 – Population and Number of Registered Vehicles by County

County	Population[2] (as of 7/1/2001)	Registered Vehicles[3]* (as of 12/31/2000)	Caltrans District
Los Angeles	9.7 million	6.2 million	7
Orange	2.9 million	2.1 million	12
San Diego	2.9 million	2.1 million	11
San Bernardino	1.8 million	1.1 million	8
Riverside	1.6 million	1.1 million	8
Ventura	0.8 million	0.6 million	7
Imperial	0.15 million	0.1 million	11
Total	**19.85 million**	**12.7 million**	

*Includes autos, trucks, and motorcycles. Trailers not included.

1.6.2 The Southern California Priority Corridor's ITS Showcase Program

The ITS Showcase Program is one of several programs that have been implemented in Southern California's Priority Corridor to help aid mobility and mitigate traffic congestion and its associated environmental impacts.

The Southern California ITS Showcase Program consists of 17 individual ITS projects that collectively form a corridor-wide intermodal transportation management and information network between Los Angeles, Orange County, San Diego, and the Inland Empire. Eleven of the projects are regional in nature, while the remaining six are corridor-wide in scope. The CWATIS project is one of the six corridor-wide projects.

The 17 Showcase projects are listed by region in Exhibit 5. Eight of the projects were fast-tracked and designated "Early Start" projects because of their importance as base infrastructure and potential to act as role models for the rest of the Showcase Program.

Exhibit 5 – The 17 Showcase Projects and their Status as of June 2003

Project	RFP Issued	Contractor Selected	Contract Executed	Project Underway	Project Complete
Corridor-wide					
Scoping & High Level Design (Kernel)*	✓	✓	✓	✓	✓
Strategic Planning/Systems Integration	✓	✓	✓	✓	✓
CVO🗎					
ATIS	✓	✓	✓	✓	✓
ATMS🗎					
Rideshare	✓	✓	✓	✓	✓
Los Angeles Region					
IMAJINE*	✓	✓	✓	✓	✓
Mode Shift*	✓	✓	✓	✓	
LA ATIS	✓	✓	✓	✓	
Inland Empire Region					
Fontana-Ontario ATMIS	✓	✓	✓	✓	
Orange County Region					
TravelTIP*	✓	✓	✓	✓	✓
OCMDI	✓	✓	✓	✓	✓
San Diego Region					
InterCAD*	✓	✓	✓	✓	✓
Mission Valley ATMIS*	✓	✓	✓	✓	
IMTMS/C (ATMSi)*	✓	✓	✓	✓	
Traffic Signal Integration (RAMS)	✓	✓	✓	✓	
Transit Management System*	✓	✓	✓	✓	

* Indicates an "Early Start" project.
🗎 CWCVO and CWATMS do not yet have approved workplans.

2 Project/System Technical Description

The initial six goals of the CWATIS project were to:

- Identify existing information elements,
- Identify priority of importance of ATIS information,
- Based on the two items above, conduct a Gap Analysis that graphs needs by importance and ease of implementation,
- Based on the Gap Analysis and stakeholder discussions, develop the order in which needs should be addressed through projects/deployments,
- Develop an ATIS Concept of Operations (ConOps) for the Priority Corridor,
- Develop a Statement of Work (SOW) and assist in the demonstration of integrating two of the Priority Corridor's traveler information systems.

The project successfully completed the first five of these goals before its scope was revised. The sixth goal of developing a SOW and assisting in the integration of two traveler information systems was modified for two primary reasons:

- None of the Showcase Program's three traveler information systems were expected to be ready for integration within the time-horizon of the CWATIS project,
- Several regionally-focused workstation developments were in process throughout the Priority Corridor, and the "Integrated Workstation" (IWS) proposed in the Corridorwide Strategic Planning Project's (CWSPP's) Systems Integration Plan offered a way to unite their capabilities. The IWS could become the integration element – not only for the two originally planned ATIS projects – but also for all of the Showcase projects (ATMS and ATIS).

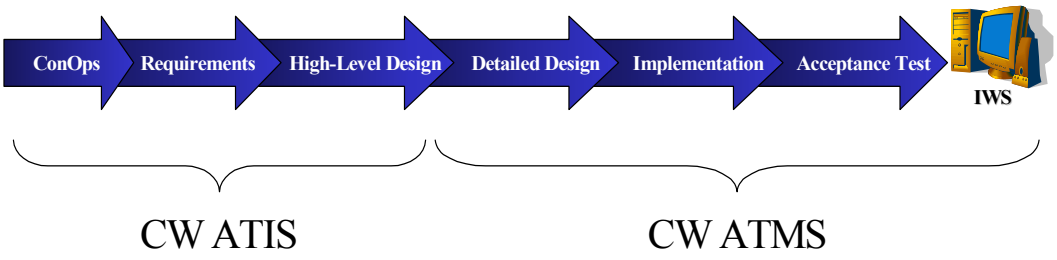
The CWATIS project's sixth goal was rescoped to help design – but not build – the IWS. The IWS would represent the next evolutionary step in the development of Showcase's interregional, corridor-wide capability by bringing together into one system all of the functionality from the various regional systems such as TravelTIP and IMAJINE. Whereas these systems were designed to process and display information from only their respective regions, the IWS would be designed to seamlessly display interregional information from throughout the corridor. The functionality provided by the IWS would include:

- Exchange of real-time traffic flow data obtained from vehicle detector stations
- Exchange of current incident information
- Shared viewing and control of CCTV video images
- Shared viewing and control of CMS messages
- Exchange of up-to-date transit routes and schedules

The CWATIS project helped build the IWS by completing the first steps of the systems engineering process, including the development of the Concept of Operations (ConOps), Requirements, and High-Level Design. The Corridor-wide Advanced Transportation

Management System (CWATMS) project, not yet underway, was planned to build on the CWATIS effort and complete the systems engineering process by developing the Detailed Design and implementing the IWS. This breakdown of the planned IWS development is depicted in Exhibit 6.

Exhibit 6 – Relationship Between the CWATIS and CWATMS Projects



3 System Performance Evaluation

3.1 The Project/System Development Process and Timeline

CWATIS is the culmination of roughly two years of effort. An RFP was issued in late 1999, and the consultant (TransCore) was selected in early 2000. The contract was executed on June 26, 2000 and the kick-off meeting was held on August 29. The milestones listed below show the project's progress.

- October 2000 – CWATIS Inventory, Compliance, and Deployment document
- November 2000 – CWATIS User Needs Assessment/Requirements
- January 2001 – CWATIS Gap Analysis and Recommendations
- April 2001 – CWATIS Operations Model
- May 2001 – CWATMS Inventory, Compliance, and Deployment document
- May 2001 – CWATMS User Needs Assessment/Requirements
- July 2001 – Integrated Workstation Sample Agreement
- August 2001 – CWATMS Gap Analysis and Recommendations
- August 2001 – CWATMS Operations Model
- September 2001 – Integrated Workstation Operations and Maintenance (O&M) Model
- November 2001 – CWATMS/ATIS Requirements and Architecture
- May 2002 – CWATMS Workplan

As the milestones above reveal, a common process was utilized to study and document the existing infrastructure, needs, priorities and gaps for both ATIS and ATMS. Unlike similar studies conducted by the regional projects, these studies conducted under the CWATIS project took a full corridor-wide view to determine the types of information and management capabilities that are most desired to be shared interregionally. The Priority Corridor's ATIS/ATMS needs were rated and plotted on a graph in terms of relative value and ease-of-deployment in order to recommend a deployment strategy for filling any gaps.

The fixed-price CWATIS contract specified a 24-month period of performance, which was successfully met when the project was completed in August 2002.

3.2 Impact of Showcase Integration on Project Deployment and System Performance

CWATIS is one of 17 projects that make up the Showcase Program and Network. As such, many interdependencies developed between the projects as plans were made for eventual regional and corridor-wide integration. This section describes how these interdependencies impacted CWATIS and other Showcase projects.

3.2.1 Impact of CWATIS on Other Showcase Projects

CWATIS Provides the Requirements and High-Level Design for CWATMS

CWATIS provided the specifications for the IWS through the development of Requirements and High-Level Design, but created no obligation to build the IWS. This effort helped identify significant overlap between the IWS concept and the San Diego region's ATMSi workstation, which was already under development. Once the project sponsors realized the similarity between the IWS and ATMSi, the CWATMS project was no longer needed to implement the IWS and the opportunity arose to reallocate the project's monies for other Showcase Program uses. Had the CWATIS and CWATMS projects been merged into a single Design-Build contract, this would not have been possible.

3.2.2 Impact of Other Showcase Projects on CWATIS

The Concept of the IWS Came from the Corridor-wide Strategic Planning Project (CWSPP)

The CWSPP's Systems Integration Plan recommended the development of an IWS as the next evolutionary step in the development and integration of Showcase's various regional systems. The IWS would aid interregional integration by bringing together the features and functionality of the regional systems into one package, and by providing a user interface with a single corridor-wide map. Design and implementation of the IWS was then assigned, respectively, to the CWATIS and CWATMS projects.

4 Cost Evaluation

The cost evaluation draws information from documented costs and personal interviews. Budget information was taken directly from the project's contract. Informal interviews were conducted to verify information and fill in any "holes" that were discovered during analysis.

4.1 Constraints & Assumptions

There are two primary considerations for the Cost Evaluation:

- Since CWATIS was funded through a firm fixed price contract, the project's budget information indicates only what was expended by the client agency but not necessarily what it cost the contractor to complete the project.
- Since CWATIS was not tasked to build the IWS, there are no operations and maintenance (O&M) costs to report.

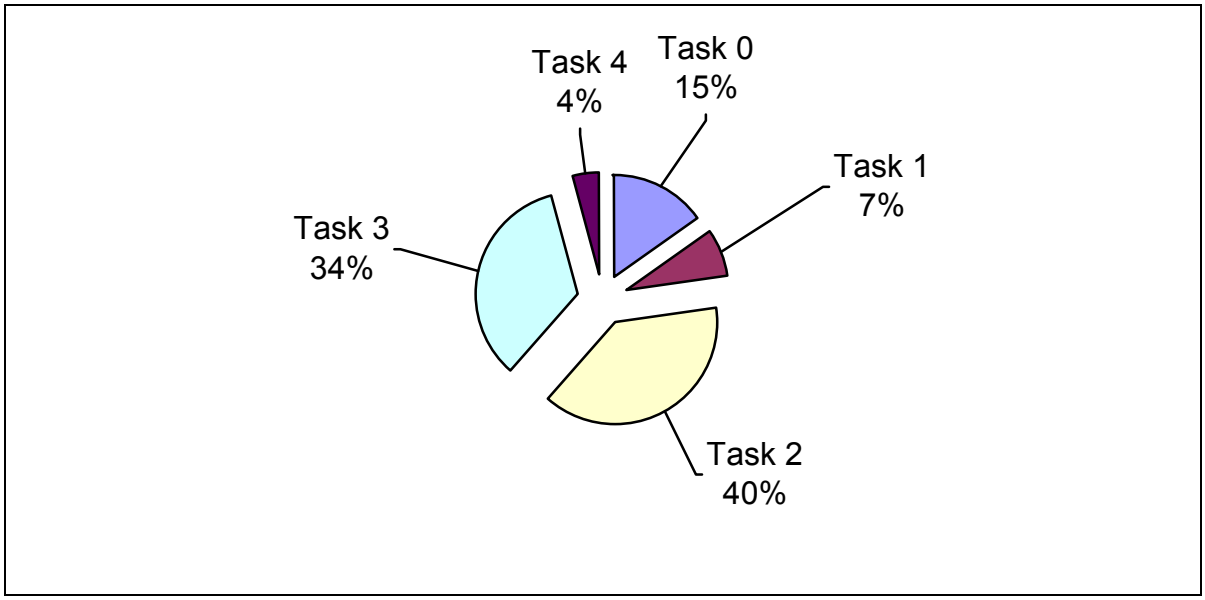
4.2 Project Budget & Estimated Development Costs

$475,000 was available for the CWATIS contract. Exhibit 7 lists the project's five tasks and the budget associated with each one, as agreed to in the project contract.

Exhibit 7 – CWATIS Project Budget per Task[4]

Task/Cost Item	Budget	%
Task 0 – Project Management	$72,693	15%
Task 1 – Assessment of Existing Projects	$35,213	7%
Task 2 – Identify Gaps and Develop Recommendations	$184,095	39%
Task 3 – ATIS/ATMS & IWS Requirements, Acceptance Test and Burn-in Plan, and High Level Design	$163,000	34%
Task 4 – CWATMS Project Work Plan	$19,999	4%
Total	**$475,000**	**100%**

Exhibit 8 – Final Distribution of CWATIS Budget by Task



5 Institutional Impacts Evaluation

5.1 Impacts to Operations and Maintenance Procedures and Policies

The CWATIS Project Developed an Operations Model for the IWS to Help Facilitate the Development of a Detailed Concept of Operations

The CWATIS project developed an Operations and Maintenance Model (OMM) to identify the variety of O&M issues that users and other stakeholders of an IWS would need to address and resolve. The document is not a detailed Concept of Operations in that it does not attempt to actually resolve these O&M issues or recommend particular solutions. Had the IWS been built, the next step would have been to use this document to guide a number of stakeholder workshops, address and resolve the issues identified, and then document the results as a set of detailed policies and procedures in a formal Concept of Operations.

5.2 Impacts to Staffing/Skill Levels and Training

No Impact to Staffing or Skill Levels

Since CWATIS was not tasked with implementing a system, the project had no impact on staffing, skill level requirements, or training requirements.

5.3 Impacts to the Competitive Environment

CWATIS developed an Operations Model, System Requirements, and High Level Design for the IWS. All of these documents are publicly available, thus providing little competitive advantage to the CWATIS project team. Furthermore, because the Design and Build phases of the IWS were split between the CWATIS and CWATMS projects, there would have been greater opportunity for contractors to compete for participation in the system's development.

5.4 Impacts to Local Planning Processes, Policy Development, and the Mainstreaming of ITS

CWATIS Developed an Operations Model of Guidelines for Integrated Multi-jurisdictional Transportation Management

As stated in Section 5.1, the CWATIS Operations Model documented general system requirements and O&M issues for agencies that are participating in multi-jurisdictional systems integration. Although this document does not have direct impact on any particular agency or policy, it does make use of lessons learned to identify the O&M policy issues that need to be addressed by stakeholders participating in integrated multi-jurisdictional transportation management.

6 Traveler and Transportation Information Management Evaluation

Since the CWATIS project was not tasked to implement a system, this portion of the evaluation is not applicable.

7 Transportation System Impacts Evaluation

Since the CWATIS project was not tasked to implement a system, this portion of the evaluation is not applicable.

8 Conclusions and Recommendations

The CWATIS project successfully conducted corridor-wide Gap Analyses for both ATIS and ATMS, and developed an Operations Model, Requirements, and High-Level Design for the IWS. One of the most noteworthy features regarding this project is how it deviates from the Design-Build approach taken by most of the other Showcase projects. By splitting the Design and Build phases into separate contracts, Caltrans was better able to estimate and control the use of resources.

Showcase's fixed-price Design-Build contracts have been a source of consternation for both the public agencies and the private contractors developing the systems. Showcase's system developers are asked to commit to a firm fixed price without knowing what, specifically, they are being asked to develop. Project scopes in the RFPs generally have been oriented towards ensuring that a systems engineering process be followed, but not clearly defining the intended end product. In fact, helping to define the end product through a Needs Assessment is often one of the first tasks in the Scope of Work. The result of a fixed-price Design-Build contract is that the agency gets only as much as the project budget will buy, but not necessarily a solution that meets all of the agency's immediate needs, requirements, or initial expectations.

Other Showcase projects have shown that the most unpredictable part of an ITS project is the design phase. The consensus building activities required to develop a satisfactory Concept of Operations (ConOps), Requirements, and High-Level Design can require this phase alone to take more than 18 months to complete. Much depends on the institutional framework, relationships, and agreements that already exist. Experience has shown that – in many cases – it is futile to proceed with a system implementation until the institutional agreements (multi-jurisdictional operations policies, cooperative agreements, MOUs, etc.) are in place to promote and support operation of the system. Delays and cost overruns resulting from failing to accurately estimate the job's requirements can put both the system developer and the agency contract manager at risk. For the system developer, this risk is financial. For the agency contract manager, the risk is that the delay or cost overrun will trigger an audit, or that the system will not be built to the stakeholder's needs/requirements.

By splitting the Design and Build phases, Caltrans was able to begin design of the system and develop a clear vision of the end product before committing any additional resources to build it. Based on this refined understanding of what they wanted to achieve, the project team was able to identify that another Showcase project (San Diego's IMTMC) was already developing a functionally similar system (the Intermodal ATMS, or ATMSi). Based on this, Caltrans chose not to proceed with the CWATMS project and the implementation of the IWS. By not "reinventing the wheel," the project team will save taxpayer dollars by utilizing ATMSi instead of continuing with the redundant development of the IWS.

Endnotes/References

[1] ISTEA requires that "operational tests utilizing federal funds have a written evaluation of the Intelligent Vehicle Highway Systems technologies investigated and the results of the investigation." Although Showcase is not officially an operational test, it deploys and demonstrates ITS services, functions, and technologies under "real world" conditions, similar to an operational test.
[2] California Statistical Abstract, Table B-4. California Department of Finance, Sacramento, CA. October 2001.
[3] California Statistical Abstract, Table J-4. California Department of Finance, Sacramento, CA. October 2001.
[4] The total project budget numbers are accurate and come from the project contract (Caltrans 3-99-70-0967a).